The Description of a Floating Collimator. By Captain Henry Kater, *F.R.S.* Read January 13, 1825. [*Phil. Trans.* 1825, *p.* 147.]

The apparatus described in this paper (of which a drawing is now laid on the table) is intended to determine the situation of the line of collimation of a telescope attached to an astronomical circle, with respect to the zenith or horizon in some one position of the instrument; in other words, to determine the zero point of the divisions on the limb. This is at present usually performed by the use of the level or the plumb line, or by the reflection of an object from the surface of a fluid. The author describes the defects and inconveniencies of each of these methods. Those of the plumb line, when applied to small instruments (to the improvement of which he describes his attention to have been particularly directed,) are referrible chiefly to want of sufficient delicacy. Those of the level are referrible to a variety of causes not under the command of the observer; while observations, by reflection, the most perfect perhaps of any now practised, require an union of favourable circumstances rarely occurring. Add to these when levels or plumb lines are used, the necessity of reversing the instrument, and observing out of the meridian. And when observations are made by reflection, that of deferring the corresponding observation to the following night, which has proved so great an inconvenience at Greenwich, as to necessitate the erection of a second circle for the purpose of simultaneous observation.

The principles on which the floating collimator is constructed are two: the first is the property of a telescope employed by Mr. Gauss, and subsequently by Mr. Bessel, in virtue of which the cross wires of a telescope adjusted to distinct vision on the stars, may be distinctly seen by another telescope, also so adjusted, at whatever distance the telescopes may be placed, provided their axes coincide; the rays diverging from the cross wires of either telescope, emerging parallel from its object-glass, and being therefore refracted by that of the other telescope to its sidereal focus, as if they came from an infinite distance. The author here translates an account by Professor Bessel, of a method of using this principle to determine the horizontal or zenith point of a circle by the use of a level, employed to place the collimating or subsidiary telescope in a horizontal position, a method which though characterized by him as the best mode of using a level that has yet been devised, is still liable to the objections urged against levels in general.

The other principle which the author substitutes in the place of the level, is the invariability with respect to the plane of the horizon of a body of determinate figure and weight floating on the surface of a fluid. In former inquiries he had satisfied himself that a body floating on mercury might be so contrived as to have always, when at rest, the same inclination to the horizon. He had thus a floating support to which he could attach a telescope,—a support requiring no adjustment, offering the ready means of extreme accuracy, and precluding all fear of those errors which might arise from the use of a level.

The collimator in its perfect state consists of a piece of cast iron 8 inches long, 4 wide, and from $\frac{1}{4}$ to $\frac{1}{2}$ an inch thick, having two uprights in the form of Y's, to which the collimating telescope is firmly fastened. The support is then floated on mercury in a deal box, somewhat larger than the flat portion of the iron, and having its bottom just covered with mercury. The float is kept in its situation in the middle of the box, and prevented from moving horizontally by two smooth iron pins projecting from its sides, and moving freely in vertical polished grooves of metal let into the sides of the box. The whole of the telescope projects above the edges of the box, and a screen of black pasteboard with an aperture equal to that of its object-glass, is fixed to the end of the box to keep off false light. The instrument was placed on a table attached to the wall of the observatory, and directed (by looking through the telescope) to the wires of a fine achromatic furnished with a wire micrometer. The cross wires of the collimator were then illuminated by a small lantern placed behind its eye-glass with oiled paper interposed.

The object of the author in this arrangement being to ascertain the limits of variability, in the position assumed by the collimator, it was deranged purposely in a variety of ways, by removing and replacing the float, or carrying the whole instrument from its place, and every method he could think of used that could fairly introduce error. His preliminary trials were made with a wooden float; but this was soon laid aside after ascertaining that the greatest single error committed in using it, did not exceed $2''{\cdot}58$ in the position of the horizontal point. Other floats were then tried, and it was found that the increase of their length and browning their surfaces with nitric acid produced material advantages. In 151 single results thus experimentally obtained, 28 only were found to give errors in the determination of the horizontal point exceeding $1''$, and only two amounting to $2''$. But if the means of every successive 5 be taken, and the experiments with the wooden float rejected, the greatest error did not exceed $0''{\cdot}4$, and even here the influence of a constant source of error depending on the support of the micrometer employed was apparent.

The author then describes at length the mode of using the collimator and of observing with it. The instrument hitherto described may be called the horizontal collimator, but he then proceeds to describe a vertical collimator, in which the telescope is fixed perpendicularly to the float and placed immediately under the axis of the circle. By this arrangement the necessity of transporting it from one side of the observatory to the other is avoided, the reverse observation being made by merely turning the float half round in azimuth.

It is not necessary that the telescope of the collimator should have a tube, nor does the author appear to regard its length as of any importance, it being merely the direction of its axis which is the subject of examination; and the accuracy of this examination will depend on the length and power of the telescope of the circle to be collimated.

The adjustment of the cross wires in the exact sidereal focus of its object-glass is, however, a point of the highest importance.

The author next points out an important advantage which this instrument presents, viz. that of enabling the observer, by varying the inclination of his float, to detect erroneous divisions of his circle by bringing different parts of its arc into use; after which he proceeds to describe an application of his floating collimator, as a permanent verification of the verticality of a zenith tube, and considers that by its use the error, if any, in the zenith distance of a star, will be ultimately referred to inaccurate bisection of the star, or imperfections in the micrometer screws.

Notice on the Iguanodon, a newly discovered Fossil Reptile, from the Sandstone of Tilgate Forest, in Sussex. By Gideon Mantell, *F.L.S. and M.G.S. Fellow of the College of Surgeons, &c. In a Letter to* Davies Gilbert, *Esq. M.P. V.P.R.S. &c. &c. &c. Communicated by* D. Gilbert, *Esq.* Read February 10, 1825. [*Phil. Trans.* 1825, *p.* 179.]

The bones of the fossil herbivorous reptile described in this paper were discovered in the sandstone of Tilgate Forest in Sussex, which is a portion of the iron-sand formation, and forms a chain of hills stretching in a W.N.W. direction from Hastings to Horsham. In this sandstone the bones and teeth in question are accompanied with those of saurian animals, turtles, birds, fishes, shells, and vegetables, among which may be satisfactorily traced the remains of a gigantic species of Crocodile, of the Megalosaurus, and of the Plesiosaurus.

The teeth of the three last-mentioned animals are readily recognised and identified; but in the summer of 1822, others were discovered in the same strata, which, though evidently referrible to some herbivorous reptile, possessed peculiar and striking characters. Anxious to ascertain the opinions of naturalists respecting these, the author submitted them to the inspection of the most eminent, and among the rest to Baron Cuvier, who, while acknowledging that such teeth were previously unknown to him, agreed in the conclusion of their belonging to some herbivorous reptile of gigantic size, and recommended every research to be made for more connected portions of the skeleton.

Confirmed in his opinion by these remarks, the author renewed his researches with increased assiduity; and though no connected portions of the skeleton have hitherto rewarded his pains, some of the specimens were discovered in so perfect a state as to allow of a comparison with the teeth of recent lacertæ in the Museum of the Royal College of Surgeons; and the result of this comparison was, that in an Iguana there deposited, teeth were discovered possessing the form and structure of the fossil specimens.

Drawings both of the recent and fossil teeth accompany this paper, and were exhibited to the Society. They show a striking corre-